found in New York, Saltville, Virginia, and Charleston, West Virginia, and salt was successfully prepared from sea water on Cape Cod from 1776. Courses in chemistry were offered at Pennsylvania, King's (Columbia), and William and Mary before 1776.

Lavoisier's recognition of the role of air in combustion, replacing the phlogiston theory; his extensive quantitative experiments; and his Traité de Chimie (1789) were the beginning of modern chemistry. Earlier texts had a completely different vocabulary and conceptual basis, but his text has been described as sounding like an old-fashioned modern text. Lavoisier's synthesis, in spite of its fundamental advance, had many precursors and contributors, as in all scientific revolu-

tions. Van Helmont (1579-1644), Robert Boyle (1627-
1691), of Boyle's law), John Mayow (1641-1679),
Stephen Hales (1677-1761), the "pneumatic chemists,"
Joseph Black (1725-1799), Joseph Priestley (1733-
1804, who discovered oxygen—a couple of years after
the Swedish chemist Scheele—but who remained a
phlogistonist), and the Russian Mikhail Lomonosov
(1711-1765, who anticipated the idea of combustion
by 1750), and many others contributed to the change
from alchemy to chemistry. Priestley emigrated to
America in 1794, but the "new" chemistry reached
America mainly from France and particularly from
Scotland, where Lavoisier's ideas were promptly ac-

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MATHEMATICS IN 1776*

ALVIN TIRMAN
East Tennessee State University
Kingsport, Tennessee 37660

ABSTRACT

An overview is presented of the history of mathematics as it developed in the eighteenth century in Europe and Colonial America.

When the eighteenth century opened, England's Isaac
Newton (1642-1727)—perhaps the greatest scientist
ever to draw breath on our planet—was alive and bitter.
It seemed to him that Gottfried Leibniz (1647-1716)
was a sneak, a cheat, and a contemptible plagiarist. He
was convinced that the German had peeked at manu-
scripts of his unpublished mathematics, and he believed
that Leibniz had taken the results and had printed them
as his own. To Leibniz, these accusations seemed un-
warranted and unfair. Although Leibniz probably had
seen portions of Newton's work on fluxions and fluents,
his own formulations of the calculus arose out of
Cavalieri's (1598-1647) geometrical approach and dif-
fiered so strongly from Newton's mechanical one that
only a bigotted blockhead could have accused him of
stealing another man's thoughts.

In this typical scientific dispute—a dispute in which
the learned disciples of both men misunderstood the
match but not the personalities—the result of the con-

The superiority of the notation devised by Leibniz soon
became evident. Using dx, dy, dy/dx and f dx, European
students progressed readily and rapidly through the
calculus and gave us a golden age of mathematics. The
English hung with Newtonian notation and died math-

To Newton, the calculus was a tool. Only out of a
necessity to solve certain problems in mechanics had
he devised it. He fathered the calculus and the study of
differential equations because they seemed to describe
natural phenomena, particularly motion. However, the
far-reaching results of his work extended well beyond
the confines of simple mechanics. In addition to rate of
change studies, the calculus soon proved indispensable
as an engineering aid in finding areas of surfaces,

THERAPY OF SOLIDS, CENTERS OF GRAVITY, MOMENTS OF INERTIA
AND STRENGTHS OF MATERIALS. It was also employed in
statistics; geometrically, it could be used to study curves,
to find their maxima and minima and their points of
inflexion.

The foundations of the calculus rested on shaky
ground which would not become secure until a later
century, when geniuses such as Cauchy, Gauss, Abel
and Bolzano would pioneer insistence on rigor in mathe-
matics. In 1734, Bishop George Berkeley (1685-1753),
one-time resident of Rhode Island, assailed the assump-
tions and the abstruseness of the calculus. In his famous
critique, The Analyst, he railed against the new mathe-
matics as being "beyond the evidence of our senses and
our understanding;" he accused his scientific opponents,
just as they had charged the adherents of religion, of
"submitting to authority, taking things on trust, and
believing points inconceivable." Unable to contradict
or confound Berkeley, his antagonists ignored him.

* Highlights of a presentation made at the General Session of
the Tennessee Academy of Science, November 1976.
In the eighteenth century, Euclid presented his Elements of Geometry (1300-1305). In 1721, Isaac Newton (1642-1727) published his Principia Mathematica, laying the foundation for the study of mechanics and calculus. In 1790, the Analytical Society was founded at Cambridge University, which led to the development of the Analytic Geometry of Descartes. By 1820, the calculus was being used in physics and astronomy, and by 1840, the theory of functions of a complex variable was being developed. By 1860, the theory of numbers had become a major branch of mathematics. In 1870, the axiomatic method was introduced by Giuseppe Peano and David Hilbert. The 19th century saw the development of non-Euclidean geometries, group theory, and the foundations of mathematical logic. In the 20th century, the development of computer science and the theory of computation were major advances in mathematics.

The evolution of mathematics and its application to the sciences has been a gradual and ongoing process. The development of mathematics has been influenced by the needs of the sciences, and the sciences have been enriched by the developments in mathematics. The development of mathematics is a continuous process, and it is impossible to give a complete history of mathematics in a single sentence. However, the main milestones in the development of mathematics can be traced back to the ancient Greeks, who developed the foundations of geometry and number theory. The development of algebra in the Islamic world, the development of calculus by Newton and Leibniz, and the development of non-Euclidean geometries in the 19th century are some of the major milestones in the development of mathematics.